



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

|                      |                     |
|----------------------|---------------------|
| <b>Predmet:</b>      | Tehniška akustika   |
| <b>Course title:</b> | Technical Acoustics |

| Študijski program in stopnja<br>Study programme and level        | Študijska smer<br>Study field | Letnik<br>Academic year | Semester<br>Semester |
|------------------------------------------------------------------|-------------------------------|-------------------------|----------------------|
| Enovit magistrski študijski program Predmetni učitelj 2. stopnje | Izobraževalna tehnika         | 3                       | 6                    |
| Five-year master's degree program Subject teacher                | Technical education           | 3                       | 6                    |

Vrsta predmeta / Course type

Izbirni / elective

Univerzitetna koda predmeta / University course code:

| Predavanja<br>Lectures | Seminar<br>Seminar | Vaje<br>Tutorial | Klinične vaje<br>work | Druge oblike študija | Samost. delo<br>Individ. work | ECTS |
|------------------------|--------------------|------------------|-----------------------|----------------------|-------------------------------|------|
| 30                     |                    | 15               |                       |                      | 45                            | 3    |

Nosilec predmeta / Lecturer:

Aleš Belšak

Jeziki /

Languages:

Predavanja / Lectures: slovenski / slovene

Vaje / Tutorial: slovenski / slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Ni pogojev.

Prerequisites:

No requirements.

**Vsebina:**

- Definicija zvoka v zraku, infrazvok, ultrazvok, akustična emisija;
- Akustika v zraku in kapljevini;
- Človeški sluh in percepcija zvoka;
- Uporabnost akustike pri spremljanju delovanja strojev;
- Osnovni fizikalni mehanizmi generiranja zvoka v zraku;
- Vrste mikrofonov;
- Kalibracija mikrofonov;
- Definicija ravni in enote decibel;
- Spektri in filtriranje signalov;
- Absorpcija zvoka;
- Zmanjševanje hrupa pri viru,
- Zaščitna sredstva;
- Akustika glasbe;
- Osnove psihoakustike.

**Content (Syllabus outline):**

- Definition of sound in air, infrasound, ultrasound, acoustic emission;
- Acoustics in air and liquid;
- Human hearing and sound perception;
- Applications of acoustics in conditioning monitoring of machines;
- Basic physical mechanisms of sound generation in the air;
- Microphone principles;
- Microphone calibration;
- Definition of decibel level;
- Spectrum and signal filtering;
- Sound absorption;
- Noise reduction;
- Protective equipment;
- Music Acoustics;
- Basic of Psychoacoustics

**Temeljni literatura in viri / Readings:**

Belšak, A., & Prezelj, J. (2013). *Vibracije in zvok v vzdrževanju* (str. III, 189). Fakulteta za strojništvo. Dodatna literatura:  
*Handbook of engineering acoustics* ([2nd ed.], str. X, 702). (2013). Springer. doi:10.1007/978-3-540-69460-1 Möser, M. (2004). *Engineering acoustics: an introduction to noise control* (str. XI, 289). Springer.

**Cilji in kompetence:****Cilji:**

- Spoznati osnovne mehanizme generiranja zvoka
- Spoznati načine širjenja zvoka po prostoru in različnih gradivih
- Razlikovati med različnimi zvočnimi pojavi in njihovimi značilnostmi
- Spoznanje o osnovnih principih izvora zvoka v stroji in napravah
- Spoznati osnovne metode meritev akustičnih veličin

**Objectives and competences:****Objectives:**

- To learn basic mechanisms of sound generation
- To understand mechanisms of sound propagation through air and different materials
- To distinguish between various sound phenomena and their characteristics
- To get to know basic principles of sound sources in machines and devices
- To get to know basic methods of measuring acoustic values

**Kompetence:**

- Spodobnost uporabe pridobljenega znanja v praksi.
- Spodobnost predstavitve osnovnih strokovnih problemov s področja akustike.
- Spodobnost povezovanja znanj iz več različnih področij tehnike v akustiki

**Competences:**

- Ability to use the attained knowledge in practice.
- Ability to present basic technical problems from acoustics.
- Ability to integrate knowledge from several different technical fields and acoustics.

**Predvideni študijski rezultati:****Znanje in razumevanje:**

Po zaključku tega predmeta bo študent sposoben:

- sistematsko pojasniti mehanizme generiranja zvoka in njihov način širjenja v prostoru
- opisati in pojasniti zakonitosti širjenja hrupa v naravni okolici, zgradbah in delovnem okolju,
- sistematsko pojasniti delovanje strojev in procesov kot virov hrupa
- razložiti osnovne metode meritev akustičnih veličin in osnovne akustične pojave

**Intended learning outcomes:****Knowledge and understanding:**

Upon completion of this course, the student will be able to:

- systematically explain the mechanisms of generating sound and its way of propagation in space
- describe and explain noise propagation in natural environment, buildings and working environment
- systematically explain the operation of machines and processes as sound sources
- explain basic methods of measuring acoustic values and basic acoustic phenomena

**Metode poučevanja in učenja:**

- frontalna predavanja,
- praktično delo pri avditornih vajah,
- izdelava seminarske naloge.

- frontal lectures,
- practical work at tutorials work,
- seminar (project) work.

Delež (v %) /

Weight (in %)

**Assessment:****Načini ocenjevanja:**

|                     |            |                    |
|---------------------|------------|--------------------|
| • teoretični izpit  | <b>40%</b> | • Theoretical exam |
| • praktični izpit   | <b>20%</b> | • Practical exam   |
| • Seminarska naloga | <b>40%</b> | • Seminar paper    |

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**Reference nosilca / Lecturer's references:**

1. POLANEC, Brigita, GLODEŽ, Srečko, BELŠAK, Aleš. Noise evaluation of coated polymer gears. *Polymers*. Feb. 2023, vol. 15, iss. 3, [article no.] 783, 22 str. ISSN 2073-4360. <https://www.mdpi.com/2073-4360/15/3/783>, DOI: 10.3390/polym15030783. [COBISS.SI-ID 140770051] projekt: P2-0063; financer: Slovenian Research Agency, Research Core Funding's projekt: OP20-04332; financer: Republic of Slovenia and the European Union under the European Structural and Investment Funds
2. TROBENTAR, Boštjan, HRIBERŠEK, Matija, KULOVEC, Simon, GLODEŽ, Srečko, BELŠAK, Aleš. Noise evaluation of S-polymer gears. *Polymers*. Jan. 2022, vol. 14, iss. 3 (438), 16 str., ilustr. ISSN 2073-4360. DOI: 10.3390/polym14030438. [COBISS.SI-ID 95101699]
3. RAMADANI, Riad, PAL, Snehashis, KEGL, Marko, PREDAN, Jožef, DRSTVENŠEK, Igor, PEHAN, Stanislav, BELŠAK, Aleš. Topology optimization and additive manufacturing in producing lightweight and low vibration gear body. *International journal of advanced manufacturing technology*. Published: 03 March 2021, str. [1-13]. ISSN 0268-3768. DOI: 10.1007/s00170-021-06841-w. [COBISS.SI-ID 54234371]